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Scaling limit of high-dimensional uniform spanning trees

Abstract:

Szekeres proved in 1982 that the diameter (length of longest path) of a uniformly drawn labeled tree on \( n \) vertices normalized by the square root of \( n \) converges in distribution to an explicitly described distribution. This random tree is just a uniformly chosen spanning tree of the complete graph on \( n \) vertices. What if one changes the underlying graph from the complete graph to, say, the hypercube \([0,1]^n\), or an expander graph, or in cubic lattices of fixed but high dimensions? Our result shows that one gets the same limiting distribution of the diameter. In fact much more is true: any reasonable "global" property of these random trees will have the same limiting distribution as a uniformly chosen labelled tree, moreover, these distributions can be explicitly described via Aldous' 1991 continuum random tree.

Joint work with Eleanor Archer and Matan Shalev.